

Component 4: Introduction to Information and Computer Science

Unit 7: Networks & Networking (Part 2 of 5)

Unit Objectives

- Understand the history of networks and their evolution.
- List and describe the various types of network communications.
- List and describe the various forms of network addressing, including DNS.
- List and define the different types of networks.
- Describe different network topologies.
- List and describe different network standards and protocols.
- Describe wireless communication.
- List and describe network hardware.
- Explain networking logical model concepts.

IP Addressing Basics

- All Internet communication utilizes IP addressing.
- The Internet expects each communicating device (known as a host) to possess an Internet Protocol (IP) address.
- Two versions of IP exist in today's networks:
 - IP version 4 has been around for nearly 50 years and is being replaced by IP version 6.

IP Address Versions

- IP version 4 (IPv4):
 - Consists of IP address and subnet mask:
 - IP address: 192.168.10.1
 - Subnet mask: 255.255.255.0
 - Means that this host is in the 192.168.10.x network.
 - IPv4 addresses almost all used up.
 - ISPs and governments now migrating to new version of IP.
 - Private networks will probably stick with IPv4 long into the future.

IP Address Versions

- IP version 6 (IPv6):
 - Uses hexadecimal characters instead of decimal numbers like IPv4:
 - Valid characters are 0-9 and A-F (to represent numbers from 10 to 15).
 - Consists of IP address and prefix number:
 - IP address: fe80:0cd0:2414:dc09:e6f5:23b1:528f:7fe2
 - Prefix: /23
 - Means that this host has a local IP address.

IPv4 Addressing Basics (cont'd)

- Given:
 - IP address: 192.168.10.1
 - Subnet mask: 255.255.255.0
- This network can legally have addresses in the range of 192.168.10.1 through 192.168.10.254.
- Networking devices and software use 192.168.10.0 and 192.168.10.255 for routing and communication.
- Valid numbers are in the range of 0-255.
- Almost all network communication uses IP addressing.

LANs Use More Than IP Addressing

- LAN communication uses IP and MAC addressing.
- The MAC (Media Access Control) address is stamped on each installed NIC.
- The MAC address is used by switches for intranet communications and has no meaning outside of that local network.
 - MAC addressing is used in all LAN communication.

MAC Address Example

- Output from a desktop computer:
 - Opened Command Prompt and ran "ipconfig /all" command.
 - IPv4 address is the IP address assigned to this NIC.
 - Physical address is the NIC's MAC address.

```
C:\Users\Instructor>ipconfig /all
Windows IP Configuration
Wireless LAN adapter Wireless Network Connection:
. . . . .
Connection-specific DNS Suffix . . . : Linksys_WMP609M_wireless-N_PCI_Adapter
Description . . . . . : 00-21-9C-48-4A-13
Physical Address. . . . . : 00-21-9C-48-4A-13
MAC address
Dhcp Enabled. . . . . : Yes
IP Address. . . . . : 192.168.100.11 (Preferred)
Subnet Mask . . . . . : 255.255.255.0
IP address
Default Gateway . . . . . : 192.168.100.109
DNS Servers . . . . . : 192.168.100.110
. . . . . : 192.168.100.110
```

How to Obtain an IP Address...

- Some IP addresses can be purchased (or leased) and used by the owner of that IP address or IP address range.
 - ✓ These are referred to as public IP addresses.
 - ✓ Most IP addresses are public addresses.
- Other IP address can be used by anyone.
 - These are referred to as private IP addresses.
 - ✓ Examples include 10.0.0.0, 172.16.31.0, and 192.168.0.0.
 - ✓ IP addressing is beyond the scope of this unit.

Domain Names

- Networks and the Internet support the use of domain names.
 - ✓ Imagine trying to navigate the Internet using IP addresses and not names!
- Since people remember names better than numbers, the Domain Naming System (DNS) was created.

What is a Domain Name?

- People and organizations can purchase a domain name from ICANN.
- According to Wikipedia:
 - “A domain name is an identification label that defines a realm of administrative autonomy, authority, or control on the Internet, based on the Domain Name System (DNS).”
- Domain names are made up of three pieces:
 - The domain name, www.whitehouse.gov indicates a government site with the purchased domain name of “whitehouse”, which is found on the WWW.

DNS - Another ISP Service

- ISPs provide a first-level of DNS servers.
 - ✓ ISP DNS servers connect to global DNS root servers for help when they cannot resolve a name to an IP address.
 - ✓ Using an ISP's DNS servers makes for a speedier browsing experience!

DNS & IP Work Well Together

- DNS maps an IP address to a domain name.
- When you visit <http://www.whitehouse.gov>, your computer must first figure out this Web site's IP address.
 - ✓ One IP address for this site is 65.126.84.121. This Web site is probably associated with many IP addresses.
- Domain name resolution is accomplished through the use of DNS servers, which are located throughout the world.

DNS & IP Work Well Together (cont'd)

- All domain names are mapped to an IP address and stored on global and privately-owned DNS servers.
- Global DNS servers are known as "root servers" and work together to map the globe's names to their IP addresses.
- When your browser learns the destination site's IP address from the DNS server, communication begins!
